Cleaning Agents for Hard Surfaces

Field of the Invention

This invention relates to cleaning compositions for hard surfaces containing a ternary surfactant mixture and electrolyte salts and to the use of these mixtures for the cleaning and antistatic finishing of painted metal surfaces, more particularly car bodies and bodywork parts.

Prior Art

In an era of heightened ecological awareness, the hand washing of motor vehicles is losing significance, even to the private car owner, because the introduction of oil-contaminated wastewater into the main drains causes serious environmental pollution. This has resulted in an increase in washing at special facilities which are equipped either with closed systems for collecting the washing water or with special oil separators. Besides so-called "wash lines" where the vehicles are successively transported through a sequence of washing, brushing and drying stations, for example on a chain conveyor, there has been a particular boom in self-service car washes where customers can clean their vehicles with a high-pressure water jet to which a water-based detergent preparation can be added if required. However, it has been found in this connection that painted metal surfaces, particularly those containing white or red igments, have a tendency to attract dust through electrostatic charging and that this dust cannot be removed by water power alone.

Reference is made in this connection to German patent application **DE 19719696 A1** (Henkel) which describes solid preparations for cleaning car bodies that contain mixtures of alkyl sulfates, alcohol ethoxylates and alkyl phosphates together with electrolyte salts. However, the cleaning performance of these known preparations is not entirely satisfactory.

Accordingly, the problem addressed by the present invention was to provide solid compositions for cleaning hard surfaces which would dissolve easily, even in cold water, would have excellent cleaning performance, preferably for oil-based soil, and at the same time would provide painted metal surfaces, more particularly car bodies and bodywork parts, with an antistatic finish that would make resoiling difficult.

Description of the Invention

The present invention relates to solid preparations containing

(a) alkyl and/or alkenyl sulfates,

(b) alcohol polyethylene glycol ethers,

(c) alkyl and/or alkenyl oligoglycosides and

(d) electrolyte salts.

It has surprisingly been found that the preparations according to the invention dissolve spontaneously and completely in water, even at low temperatures, and form a cleaning composition with which, for example, motor vehicles and other painted metal surfaces can be quickly and effectively freed from grease and oil residues and other soils. At the same time, the compositions provide the parts thus treated with an antistatic finish which makes resoiling very difficult. The invention includes the observation that the high cleaning performance is very largely attributable to a synergistic effect between the glycosides and the electrolyte salts, more particularly the inorganic phosphates.

Alkyl and/or alkenyl sulfates

Alkyl and/or alkenyl sulfates, which are often referred to as fatty alcohol sulfates and which orm surfactant component (a), are the sulfation products of primary alcohols which correspond to formula **(I)**:

$$R^1O\text{-}SO_3X \qquad (I)$$

in which R^1 is a linear or branched aliphatic alkyl and/or alkenyl group containing 6 to 22 carbon atoms, preferably 12 to 18 carbon atoms and X is an alkali metal and/or alkaline earth metal, ammonium, alkylammonium, alkanolammonium or glucammonium. Typical examples of alkyl sulfates which may be used for the purposes of the invention are the sulfation products of caproic alcohol, caprylic alcohol, capric alcohol, 2-ethylhexyl alcohol, lauryl alcohol, myristyl alcohol, cetyl alcohol, palmitoleyl alcohol, stearyl alcohol, isostearyl alcohol, oleyl alcohol, elaidyl alcohol, petroselinyl alcohol, arachyl alcohol, gadoleyl alcohol, behenyl alcohol and erucyl alcohol and the technical mixtures thereof obtained by high-pressure hydrogenation of technical methyl ester fractions or aldehydes from Roelen's oxo synthesis. The sulfation products may advantageously be used in the form of their alkali metal salts, more particularly their sodium salts. Alkyl sulfate powders or needles based on $C_{16/18}$ tallow fatty alcohols or vegetable fatty alcohols of comparable C-chain distribution in the form of their sodium salts are particularly preferred.

Alcohol polyethylene glycol ethers

Alcohol polyethylene glycol ethers which form component (b) are nonionic surfactants which are industrially obtained by addition of ethylene oxide onto primary, linear or branched alcohols. Alcohol polyethylene glycol ethers particularly suitable for the purposes of the invention correspond to formula **(II)**:

$$\mathbf{R^2O\text{-}(CH_2CH_2O)_nH} \qquad \mathbf{(II)}$$

in which R^2 is a linear or branched alkyl and/or alkenyl group containing 6 to 22 carbon atoms and n is a number of 1 to 50. Typical examples are products of the addition of on average 1 to 50 and more particularly 20 to 30 moles of ethylene oxide onto caproic alcohol, caprylic alcohol, 2-ethyl

hexyl alcohol, capric alcohol, lauryl alcohol, isotridecyl alcohol, myristyl alcohol, cetyl alcohol, palmitoleyl alcohol, stearyl alcohol, isostearyl alcohol, oleyl alcohol, elaidyl alcohol, petroselinyl alcohol, arachyl alcohol, gadoleyl alcohol, behenyl alcohol, erucyl alcohol and brassidyl alcohol and technical mixtures thereof. The alcohol polyglycol ethers may have both a conventional and a narrow homolog distribution. It is particularly preferred to use addition products of on average 20 to 30 moles ethylene oxide onto technical $C_{12/14}$ or $C_{12/18}$ coconut fatty alcohol fractions or tallow fatty alcohol.

Alkyl and/or alkenyl oligoglycosides

Alkyl and alkenyl oligoglycosides form surfactant component (c) and are known nonionic surfactants which correspond to formula **(III)**:

$$R^3O\text{-}[G]_p \qquad \textbf{(III)}$$

where R^3 is an alkyl and/or alkenyl group containing 4 to 22 carbon atoms, G is a sugar unit containing 5 or 6 carbon atoms and p is a number of 1 to 10. They may be obtained by the relevant methods of preparative organic chemistry. **EP-A1 0 301 298** and **WO 90/03977** are cited as representative of the extensive literature available on the subject. The alkyl and/or alkenyl oligoglycosides may be derived from aldoses or ketoses containing 5 or 6 carbon atoms, preferably glucose. Accordingly, the preferred alkyl and/or alkenyl oligoglycosides are alkyl and/or alkenyl oligo**glucosides**. The index p in general formula **(III)** indicates the degree of oligomerization (DP), i.e. the distribution of mono- and oligoglycosides, and is a number of 1 to 10. Whereas p in a given compound must always be an integer and, above all, may assume a value of 1 to 6, the value p for a certain alkyl oligoglycoside is an analytically determined calculated quantity which is generally a broken number. Alkyl and/or alkenyl oligoglycosides having an average degree of oligomerization p of 1.1 to 3.0 are preferably used. Alkyl

and/or alkenyl oligoglycosides having a degree of oligomerization of less than 1.7 and, more particularly, between 1.2 and 1.4 are preferred from the applicational point of view. The alkyl or alkenyl group R^3 may be derived from primary alcohols containing 4 to 11 and preferably 8 to 10 carbon atoms. Typical examples are butanol, caproic alcohol, caprylic alcohol, capric alcohol and undecyl alcohol and the technical mixtures thereof obtained, for example, in the hydrogenation of technical fatty acid methyl esters or in the hydrogenation of aldehydes from Roelen's oxosynthesis. Alkyl oligoglucosides having a chain length of C_8 to C_{10} (DP = 1 to 3), which are obtained as first runnings in the separation of technical C_{8-18} coconut oil fatty alcohol by distillation and which may contain less than 6% by weight of C_{12} alcohol as an impurity, and also alkyl oligoglucosides based on technical $C_{9/11}$ oxoalcohols (DP = 1 to 3) are preferred. In addition, the alkyl or alkenyl group R^3 may also be derived from primary alcohols containing 12 to 22 and preferably 12 to 14 carbon atoms. Typical examples are lauryl alcohol, myristyl alcohol, cetyl alcohol, palmitoleyl alcohol, stearyl alcohol, isostearyl alcohol, oleyl alcohol, elaidyl alcohol, petroselinyl alcohol, arachyl alcohol, gadoleyl alcohol, behenyl alcohol, erucyl alcohol, brassidyl alcohol and technical mixtures thereof which may be obtained as described above. Alkyl oligoglucosides based on hydrogenated $C_{12/14}$ cocoalcohol with a DP of 1 to 3 are preferred.

Electrolyte salts

Suitable electrolyte salts, which represent the principal constituents of the compositions according to the invention, are for example alkali metal and/or alkaline earth metal phosphates, hydrogen phosphates, carbonates, hydrogen carbonates, sulfates, silicates, acetates, citrates and the like. Typical examples are sodium tripolyphosphate, potassium tripolyphosphate, sodium hydrogen phosphate, potassium hydrogen phosphate, sodium carbonate, potassium carbonate, calcium carbonate, sodium

hydrogen carbonate, potassium hydrogen carbonate, sodium sulfate, potassium sulfate, magnesium sulfate, calcium sulfate, sodium metasilicate, potassium metasilicate, sodium acetate, potassium acetate, magnesium carbonate, calcium acetate, sodium citrate and/or potassium citrate. Other suitable electrolyte salts are alumosilicates, such as the zeolites known as detergent builders.

Organic builders

In one preferred embodiment of the invention, the compositions contain organic builders, for example ethylenediamine tetraacetate (EDTA), nitrilotriacetate (NTA), citric acid and the like, in order further to improve their drainage behavior on the hard surfaces. In addition, it has proved to be of advantage to use sulfonated styrene/maleic anhydride copolymers, for example of the type marketed under the name of Versa® TL-3 by National Starch & Chemical Ltd., particularly for solid compositions. The anionic polymers are generally used in quantities of 1 to 25% by weight and preferably in quantities of 2 to 10% by weight, based on the composition.

Cleaning compositions

Substantially water-free compositions containing - based on their solids content -

(a) 1 to 10, preferably 2 to 6% by weight of alkyl and/or alkenyl sulfates,

(b) 1 to 10, preferably 3 to 8% by weight of alcohol polyethylene glycol ethers,

(c) 1 to 10, preferably 2 to 4% by weight of alkyl and/or alkenyl polyglycosides,

(d) 80 to 90, preferably 85 to 88% by weight of electrolyte salts and

(e) 0 to 25, preferably 1 to 10% by weight of builders

with the proviso that the quantities shown add up to 100% by weight, have

proved to be optimal for solving the problem addressed by the present invention. The compositions have a water content of less than 5% by weight, preferably less than 2% by weight, and a pH value in the range from 9 to 12. The compositions can be produced by known methods, i.e. in the simplest form, powder mixtures with bulk densities of 650 to 750 g/l are produced in a mixer, for example a Schugi mixer. Basically, it is of course also possible to use the known industrial processes for the production of washing powders, i.e. for example the drying of water-containing slurries with hot gases (spray drying) or superheated steam (steam drying) in countercurrent, fluidized bed agglomeration (SKET granulation), simultaneous drying and granulation in a horizontal thin-layer evaporator (flash drying) and the like. Besides the ingredients mentioned above, the compositions may contain other surfactants, for example sulfosuccinates, sulfosuccinamates, sorbitan esters, polysorbates, amine ethoxylates, quaternized amine ethoxylates, esterquats or betaines, and also saturated or unsaturated fatty acids, silicone oils and Guerbet alcohols.

Commercial Applications

The compositions according to the invention dissolve readily in water, including cold water, remove soil, including obstinate soil, from painted metal surfaces and provide those surfaces with an antistatic finish against re-soiling. Accordingly, they may of course also be marketed in the form of aqueous concentrates with a solids content of 15 to 50% by weight or even in the form of a diluted 5 to 15% by weight liquid. The present invention also relates to their use for the simultaneous cleaning and antistatic finishing of painted metal surfaces, especially car bodies and bodywork parts.

Examples

In order to evaluate their performance properties, compositions 1 to 3 according to the invention and comparison mixtures C1 to C3 were tested for their cleaning performance, their antistatic effect and their drainage behavior. Cleaning performance was tested by coating a red-painted metal plate (10 x 10 cm) with 5 g of lubricating oil and then treating it for 20 seconds with a 5% by weight aqueous solution of the test substances in the form of a concentrated water jet ("Kärcher"). The residue was then incinerated, weighed out and placed in a ratio to the amount of oil originally applied, i.e. the lower the value, the higher the performance. The antistatic finish was evaluated by the conductivity method using red-painted metal plates. The higher the resistance value observed, the better the antistatic charging and the lower the tendency to attract dust. Drainage behavior was subjectively determined - "+++" stands for very rapid drainage, "-" for slow drainage. The results are set out in Table 1 below.

Table 1

Solid preparations and performance properties

Composition /performance	1	2	3	C1	C2	C3
$C_{12/16}$ alkyl sulfate Na salt	5.0	5.0	4.0	0	5.0	0
$C_{16/18}$ tallow fatty alcohol+25 EO	3.0	3.0	4.0	0	0	5.0
$C_{12/14}$ cocoalkyl oligoglucoside	1.0	2.0	2.0	5.0	0	0
Sodium tripolyphosphate	50.0	50.0	50.0	50.0	50.0	50.0
Sodium metasilicate	15.0	15.0	15.0	15.0	15.0	15.0
Sodium carbonate	26.0	24.0	24.0	30.0	30.0	30.0
Versa TL-3*	-	2.0	2.0	-	-	-
Cleaning performance [%]	10	10	10	44	35	37
Conductivity [mS]	7.9	8.5	8.5	2.3	0.3	0.2
Drainage behavior	++	+++	+++	-	-	-

*) Sulfonated styrene/MA copolymer, sodium salt